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(54) Thermal radiation baffle for apparatus for use in directional solidification

Thermische Abschirmung für einen Apparat zur Verwendung bei gerichteter Erstarrung

Paroi contre la radiation thermique pour utiliser dans une solidification dirigée

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Description

This invention relates to a thermal radiation baffle for apparatus for use in the directional solidification of crystalline material, in particular, to obtain high strength articles of metal alloys.

In one general form for such apparatus a furnace, in which molten material is poured into a mould to cast the required article, is mounted vertically above means for rapidly cooling the molten material in the mould. The means for rapidly cooling the molten material may have one of several different constructions. In general, such means comprises a chill plate on which the mould is mounted, and the arrangement associated with the plate is so that heat can be extracted therefrom, and hence also from the mould, at a high rate. The chill plate is movable, in a controlled manner in a vertical direction, and drive means for the plate is provided. The drive means initially causes the mould to be located in the furnace; and then causes the mould to be withdrawn from the furnace, so that the molten material then in the mould is solidified.

It is required for the production of high strength articles by directional solidification that the molten material in the mould should start to solidify at the chill plate. Further, the arrangement is to be so that a sharply defined interface between the solidified and molten material is obtained; and that this interface moves in the required direction of crystallisation of the material. For the general form of apparatus referred to above, this direction of interface movement is opposite to the vertical direction of relative movement of the chill plate and filled mould away from the furnace. The speed of movement of the chill plate can have any desired value; but it is required that heat is removed from the chill plate as quickly as possible; and that the rate of heat supplied to the parts of the mould displaced from the furnace by radiation from the furnace, is as small as possible. In order that the latter criterion is obtained it is known to provide a thermal radiation baffle of a refractory material mounted at the lower end of the furnace, and through which baffle the filled mould is withdrawn. The empty mould is also required to pass through the baffle in the reverse direction.

Many different constructions for such a thermal radiation baffle are known. For example, it is disclosed in US patent specification US-A-3,714,977 to provide a layer of shell mould material; with an overlying layer of graphite fibres, this fibre layer having a random construction to comprise a felt; and there being a permanent aperture for the passage of the mould through the centre of the baffle. The two layers are secured together, with the inner periphery of the apertured felt layer extending beyond the corresponding inner periphery of the other layer, substantially into contact with the mould. The felt is flexible to a degree, and the mould may move freely past the edge of the felt layer, this edge being capable of deforming to some extent if necessary, and if contacted by the mould.

US-A-4 969 501 discloses a thermal radiation baffle. The seal portion of the baffle includes an annular array of flexible segments being separated by radial slits. The seal portion is formed from plural layers of graphite foil.

It is an object of the present invention to provide a novel and advantageous construction for a thermal radiation baffle for apparatus for use in directional solidification.

In accordance with the present invention a thermal radiation baffle for apparatus for use in directional solidification of crystalline material, the baffle being mounted at one end of a furnace, and, in use, there is to be a linear relative movement between a mould and the baffle when the mould is to be removed from the furnace, has clamped within the baffle at least one layer of interconnected flexible strips of refractory material, and each such layer comprises an ordered construction of the strips, and has at least one slit therein to enable the mould to pass through the layer with the edges of each slit engaging the mould in a resilient manner, and at least substantially the whole of each slit is inclined at a significant angle to the strips.

The present invention is now described by way of example with reference to the accompanying drawings, in which

Figure 1 is a plan view of part of one embodiment of a thermal radiation baffle for apparatus for use in directional solidification of crystalline material, this Figure showing a clamped layer of interconnected flexible strips of refractory material, the layer having an ordered construction, the illustrated layer having interwoven strips, and the layer has a linearly extending slit therein,

Figure 2 is a plan view of the layer shown in Figure 1 when a mould is passing through the slit,

Figure 3 corresponds to Figure 1, but shows an orthogonal, symmetrical arrangement of two intersecting slits in the layer,

Figure 4 corresponds to Figure 3, but shows a permanent circular aperture provided at the centre of the orthogonal slits,

Figure 5 is an exploded view of part of a baffle having two clamped layers of interwoven strips, each constituent layer having the construction shown in Figure 1 with a single linearly extending slit therein, in this baffle the two layers being arranged with the slits orthogonal,

Figure 6 corresponds to Figure 2, but is a plan view of the baffle of Figure 5 when a mould is passing through the slits,

Figure 7 is an exploded view of a baffle having two

clamped layers, one layer is of interwoven flexible strips having a single linearly extending slit therein, and the other, stiffer, layer solely has a permanent aperture therein, and

Figure 8 is a plan view of part of another baffle equivalent to the baffle of Figure 1 with a linearly extending slit, in this other baffle the clamped layer comprises two separate, but adjacent, pieces of interwoven strips.

The embodiment of a thermal radiation baffle 10 for apparatus for use in directional solidification, and shown partially in Figure 1, comprises a clamped layer 12 of interwoven strips 14. For convenience, the means for clamping the layer 12, and for mounting the baffle 10 at one end of a furnace, are not shown. In the illustration the warp and weft strips 14 are represented as being at right angles to each other. A linearly extending slit 16 extends at the significant angle of 45° to the strips 14, across the central part of the clamped layer 12. The strips 14 are of refractory material.

Shown in Figure 2 is a circular section mould 18 passing through the centre of the slit 16 in the layer 12. The slit 16 becomes deformed, and the central part of the slit tends to conform to the shape of the mould 18. At its extremities the slit 16 is opened. However, whilst the baffle 10 is less efficient as a shield for radiation from the furnace when the mould 18 is passing through the slit 16, compared with when the slit 16 is closed, as shown in Figure 1 the layer 12 does comprise an effective thermal radiation baffle throughout its use.

The interconnected strips have to be of a reasonably flexible material, for example, comprising carbon ribbons reinforced with fibres of carbon, or of a suitable ceramic, or of a suitable refractory metal; or the interconnected strips may be significantly flexible yarns. In this specification, and the accompanying claims, the term yarn is employed to include references to, for example, monofilaments; untwisted rovings; and single, double or multiple strands, which may be twisted. For such yarns the refractory material may be carbon; silicon carbide, alumina, or any suitable ceramic material; or any suitable refractory metal.

In one particular example of a thermal radiation baffle in accordance with the present invention the interconnected strips each comprise a 3000 filament tow of carbon fibre. A layer is produced therefrom by plain weaving warp and weft strips, with 5 strips being provided per centimetre. The layer obtained weighed 200 grams per square metre, and had a thickness of 0.32 millimetres. The thermal radiation baffle produced from the layer had a disc of this material approximately 500 millimetres in diameter, and within this disc was a linear slit approximately 250 millimetres long.

Because the layer of the baffle is provided by an ordered arrangement of interconnected strips, and having the slit provided therein inclined at a significant angle to the strips, the baffle is advantageous because it is robust; and the slit readily recloses after being opened by the mould; and the strips do not tend to become detached, or damaged, in use. For this purpose the slit may be inclined at any significant angle, greater than, or equal to, 10° to the strips. In addition, whilst the mould is passing through the baffle, the layer of interconnected strips resiliently engages the mould. The arrangement may be such that ends of the strips protrude into re-entrant parts of an irregular shaped mould to provide a more effective barrier for radiation from the furnace.

The construction of the thermal radiation baffle 20 shown in Figure 3 is the same as that of the baffle 10 of Figures 1 and 2, except that two orthogonal slits 26 extend across the central part of the clamped layer 22. The warp and weft strips 24 are at right angles to each other, and all these strips are inclined at the significant angle of 45° to both slits 26. This arrangement enables the layer 22 to be a closer fit around the mould than the layer 12 of Figures 1 and 2; but the layer 22 is less resilient, and the slits 26 do not close as easily as the slit 16 in the layer 12.

The, or at least one, slit in the layer of interconnected strips may not extend wholly linearly. If any portion of a slit is inclined at an angle less than an appropriate significant angle to the strips, conveniently, this slit portion does not contact the mould, so that strips providing this slit portion do not become frayed or detached.

The baffle 30 shown in Figure 4 is to be employed with a particular mould, and a permanent aperture 38 is provided therein. This permanent aperture 38 corresponds to the smallest cross-sectional shape of the mould with respect to the axis of relative movement of the mould and the baffle 30. The permanent aperture 38 is in the central part of the layer 32 of the baffle. Otherwise the baffle 30 has the same construction as the baffle 20 shown in Figure 3, having two orthogonal slits 36 inclined at the significant angle of 45° to the warp and weft strips 34. This arrangement is particularly useful when large moulds are employed, and facilitates the layer 32 being a close fit around the mould. However, inherently more radiation passes through the baffle 30 when the mould is not passing through the baffle, compared with the amount of radiation passed by the baffle 20 of Figure 3.

The thermal radiation baffle 40 shown in Figures 5 and 6 comprises two layers 41 and 42 of interwoven strips 44, the layers being clamped in contact with each other. Each layer 41 or 42 has the same construction as the layer 12 of the baffle 10 of Figure 1, having therein a linearly extending slit, respectively, 45 or 46. In the assembled baffle 40 the two layers 41 and 42 are orientated so that the two slits 45 and 46 are at right angles to each other. Further, as shown in Figure 6, when the mould 48 is passing through the slits 45 and 46, and the slit 46 in the underlying layer 42 being indicated in dotted line form, substantially the whole of the mould surface is contacted by one or other of the layers 41 and

42. Hence, a more effective thermal radiation baffle is provided than if a single layer having single slit is provided, as shown in Figure 2. The baffle 40 is also more effective as a radiation shield than if two orthogonal slits 26 are provided in a single layer 22, as shown in Figure 3.

A conformable baffle in accordance with the present invention can be provided with any appropriate arrangement for the slits in the, or at least one, layer, in order to provide a tight fit continuously with the mould, when the mould is passing therethrough, and possibly with substantially the whole of the periphery of the mould at the level instantaneously contacted by the strips. Such an appropriate arrangement of slits may accommodate a mould of a complex and irregular shape, possibly having varying irregular cross-sectional shapes along its axis parallel to the direction of relative movement between the mould and the baffle. Further, it is not necessary for the arrangement of slits to be symmetrical about the centre of the layer, particularly if the centre of the mould is spaced from the axis of relative movement between the mould and the baffle.

A layer of interwoven strips may have any suitable form, for example, a plain, twill, or satin weave may be used; and the strips may not be orthogonally arranged.

A three-dimensional ordered construction for a layer may be obtained by some of the weft strips extending at right angles to the plane of the layer, in order to join together two or more constituent sets of the warp strips. Alternatively, two or more provided constituent sets of strips may be secured together by stitching, needling or bonding; or by any other convenient method. Such a three-dimensional construction may have both high robustness and high flexibility.

Alternatively, in essentially a two-dimensional construction, more than one warp and/or weft set of strips may be employed, say, to obtain a hexagonal weave.

Further, the, or at least one, layer of interconnected strips, of an appropriate flexibility, and especially when the strips comprise yarns, may have an ordered construction by comprising a knitted layer, particularly, having an interlocked knitted construction.

When a plurality of layers of interconnected strips are provided in a baffle, different layers of interconnected strips may have different, ordered constructions. Thus, for example, one layer has an interwoven construction, whilst another layer has a knitted construction. In addition, or alternatively, one layer comprises flexible yarns, and another layer is of relatively more rigid and brittle strips. In addition, or alternatively, different layers may have different arrangements of slits and/or permanent apertures therein.

In addition to having at least one layer of interconnected strips, with an ordered construction of the strips, a baffle in accordance with the present invention may also have a layer not having such an ordered construction, for example, the additional layer not comprising interconnected strips, but possibly having at least one slit provided therein.

Alternatively, a baffle in accordance with the present invention, in addition to having at least one layer of interconnected strips, with an ordered construction of the strips, and each such layer having at least one slit therein, with at least substantially the whole of each slit inclined at a significant angle to the strips, also has a permanently apertured layer having a similar construction, but not having such a slit.

It may be desirable to have the outer parts of a baffle formed in any convenient manner to be stiffer than the inner parts contacting the mould, in order to prevent undesirable sagging of the baffle.

The thermal radiation baffle 50 illustrated in Figure 7 also has two constituent clamped layers 51 and 52, but the two layers have different constructions, the layer 51 being of interwoven graphite strips 53, and the layer 52 comprising a continuous foil indicated generally at 54. The layer 52 is stiffer than the layer 51. The layer 51 is shown as having a linearly extending slit 55 therein, and has the same construction as the layer 12 of the baffle 10 of Figure 1. The layer 52 is shown as having solely a circular permanent aperture 56 therethrough, this aperture corresponding to the smallest cross-sectional shape of the mould with respect to the axis of relative movement of the mould and the baffle 50. Whilst the layer 52, considered in isolation, is not constructed in accordance with the present invention, in combination with a layer which is constructed in accordance with the present invention, such as the layer 51, provides a baffle 50 in accordance with the present invention, combining the advantageous resilient flexibility of the layer 51 and the relative stiffness of the layer 52 at the outer parts of the baffle. It is possible that the layer 52 could be formed from interconnected strips.

The outer parts of a baffle remote from the, or each, slit may be selectively stiffened by impregnation of the, or at least one constituent layer with, say, a suitable ceramic cement, or a carbonisable resin.

The, or at least one, clamped layer may have at least one slit provided between two separate pieces of interconnected strips adjacent in the plane of the layer, at each adjacent edge of the pieces the arrangement being such that at least substantially the whole of the slit is inclined at a significant angle to the strips forming the associated pieces.

Thus, the baffle 60 shown in Figure 8 has the equivalent construction to that of the baffle 10 shown in Figure 1, however the clamped layer comprises two separate, adjacent pieces 61 and 62 of interwoven strips 64. Between the two pieces is a slit 66 corresponding to the slit 16 of the baffle 10 of Figure 1, but the slit 66 extends linearly across the whole of the composite clamped layer. Abutting edges 68 of the two pieces 61 and 62 form the slit 66, and extend at the significant angle of 45° to all the interwoven strips 64 forming the pieces 61 and 62. Instead of abutting, the two adjacent edges 68 of the pieces 61 and 62 may be in overlapping relationship with each other. However, there can be considered to be an effective slit in accord-

ance with the present invention between the two pieces 61 and 62.

Claims

1. A thermal radiation baffle (10) for apparatus for use in directional solidification of crystalline material, the baffle being mounted at one end of a furnace, and, in use, there is to be a linear relative movement between a mould and the baffle when the mould is to be removed from the furnace, characterised in that there is clamped within the baffle at least one layer (12; 22; 32) of interconnected flexible strips (14; 24; 34) of refractory material, and each such layer comprises an ordered construction of the strips, and has at least one slit (16; 26; 36) therein to enable the mould to pass through the layer with the edges of each slit engaging the mould in a resilient manner, and at least substantially the whole of each slit is inclined at a significant angle to the strips.

2. A baffle as claimed in Claim 1 characterised in that the, or at least one, layer of interconnected strips has an ordered construction by comprising interwoven strips.

3. A baffle as claimed in Claim 1, or Claim 2, characterised in that the interconnected strips of the, or at least one, layer comprise yarns.

4. A baffle as claimed in Claim 3, characterised in that the, or at least one, layer of interconnected strips has an ordered construction by comprising knitted yarns.

5. A baffle as claimed in any one of the preceding claims characterised in that at least substantially the whole of the or each slit is inclined at a significant angle greater than, or equal to, 10° to the strips.

6. A baffle as claimed in any one of the preceding claims, characterised in that the, or at least one, slit in a layer of interconnected strips extends wholly linearly.

7. A baffle as claimed in any one of the preceding claims, characterised in that the strips of the layer are orthogonally interwoven, and each provided linearly extending part of each slit is inclined at the significant angle of 45° to all the strips.

8. A baffle as claimed in any one of the preceding claims, characterised in that in the, or at least one, layer of interconnected strips is provided with a permanent aperture, in addition to the, or each, slit.

9. A baffle as claimed in any one of the preceding claims, characterised in that a plurality of layers of interconnected strips are provided, and the slits in different layers are not aligned with each other.

10. A baffle as claimed in any one of the preceding claims, characterised in that a plurality of layers of interconnected strips are provided, and different layers have different, ordered constructions.

11. A baffle as claimed in any one of the preceding claims, characterised in that the, or at least one, clamped layer has at least one slit provided between two separate pieces of interconnected strips adjacent in the plane of the layer, at each adjacent edge of the pieces the arrangement being such that at least substantially the whole of the slit is inclined at a significant angle to the strips forming the associated pieces.

12. A baffle as claimed in Claim 11, characterised in that the adjacent edges of the pieces abut each other.

13. A baffle as claimed in Claim 11, characterised in that the adjacent edges of the pieces are in overlapping relationship with each other.

14. A baffle as claimed in any one of the preceding claims, characterised in that, in addition to having at least one layer of interconnected strips, with an ordered construction of the strips, there is provided a layer not having such an ordered construction.

15. A baffle as claimed in any one of Claims 1 to 13, characterised in that, in addition to having at least one layer of interconnected strips, with an ordered construction of the strips, and each such layer having at least one slit therein, with at least substantially the whole of each slit inclined at a significant angle to the strips, there is also provided a permanently apertured layer (52) having a similar construction, but not having such a slit.

Patentansprüche

1. Eine thermische Strahlungsabschirmung (10) für einen Apparat zur Verwendung bei gerichteter Erstarrung von kristallinem Material, wobei die Abschirmung an einem Ende eines Ofens montiert ist und bei Gebrauch dort eine lineare Relativbewegung zwischen einer Form und der Abschirmung auftritt, wenn die Form vom Ofen entfernt werden muß, dadurch gekennzeichnet, daß in der Abschirmung wenigstens eine Schicht (12;22;32) von untereinander verbundenen flexiblen Streifen (14;24;34) aus hitzebeständigem Werkstoff festgeklemmt ist und jede solche Schicht einen geordneten Aufbau der Streifen umfaßt und wenigstens mit einem Schlitz (16;26;36) in ihr versehen ist, um

einen Durchlauf der Form durch die Schicht zu ermöglichen, wobei die Kanten jedes Schlitzes mit der Form in einer elastischen Weise in Eingriff stehen, und zumindest im wesentlichen die Gesamtheit jedes Schlitzes zu den Streifen um einen erheblichen Winkel geneigt ist.

2. Abschirmung, wie in Anspruch 1 beansprucht, dadurch gekennzeichnet, daß die oder zumindest eine Schicht von untereinander verbundenen Streifen einen geordneten Aufbau aufweist, indem sie geflochtene Streifen umfaßt.

3. Abschirmung, wie in Anspruch 1 oder Anspruch 2 beansprucht, dadurch gekennzeichnet, daß die untereinander verbundenen Streifen der oder zumindest einer Schicht Garne aufweisen.

4. Abschirmung, wie in Anspruch 3 beansprucht, dadurch gekennzeichnet, daß die oder zumindest eine Schicht von untereinander verbundenen Streifen einen geordneten Aufbau aufweist, indem sie gestrickte Garne umfaßt.

5. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß zumindest im wesentlichen die Gesamtheit des oder jedes Schlitzes um einen erheblichen Winkel größer als oder gleich 10° zu den Streifen geneigt ist.

6. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß der oder zumindest ein Schlitz in einer Schicht von untereinander verbundenen Streifen sich in Gänze linear erstreckt.

7. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß die Streifen der Schicht orthogonal verflochten sind und jeder linear sich erstreckende Teil jedes Schlitzes um den erheblichen Winkel von 45° zu allen Streifen geneigt ist.

8. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß die oder zumindest eine Schicht von untereinander verbundenen Streifen mit einer permanenten Öffnung zusätzlich zu dem oder jedem Schlitz versehen ist.

9. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß eine Mehrzahl von Schichten von untereinander verbundenen Streifen vorgesehen und die Schlitze in unterschiedlichen Schichten nicht zueinander ausgerichtet sind.

10. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß eine Vielzahl von Schichten von untereinander verbundenen Streifen vorgesehen sind und unterschiedliche Schichten einen unterschiedlichen, geordneten Aufbau aufweisen.

11. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß die oder zumindest eine festgeklemmte Schicht zumindest einen Schlitz aufweist, der zwischen zwei getrennten Stücken untereinander verbundener, benachbarter Streifen in der Ebene der Schicht ausgebildet ist, wobei an jeder benachbarten Kante der Stücke die Anordnung so gewählt ist, daß zumindest im wesentlichen die Gesamtheit des Schlitzes um einen erheblichen Winkel zu den Streifen, welche die zugeordneten Stücke formen, geneigt ist.

12. Abschirmung, wie sie in Anspruch 11 beansprucht ist, dadurch gekennzeichnet, daß die benachbarten Kanten der Stücke gegeneinander anliegen.

13. Abschirmung, wie sie in Anspruch 11 beansprucht ist, dadurch gekennzeichnet, daß die benachbarten Kanten der Stücke in einander überlappender Weise angebracht sind.

14. Abschirmung, wie sie in irgendeinem der vorhergehenden Ansprüche beansprucht ist, dadurch gekennzeichnet, daß zusätzlich zur Anordnung zumindest einer Schicht untereinander verbundener Streifen mit einem geordneten Aufbau der Streifen noch eine Schicht vorgesehen ist, die keinen solchen geordneten Aufbau aufweist.

15. Abschirmung, wie sie in irgendeinem der Ansprüche 1 bis 13 beansprucht ist, dadurch gekennzeichnet, daß zusätzlich zur Anordnung mindestens einer Schicht untereinander verbundener Streifen mit einem geordneten Aufbau der Streifen und der Ausbildung jeder solcher Schicht derart, daß sie zumindest einen Schlitz in ihr aufweist, wobei zumindest im wesentlichen die Gesamtheit jedes Schlitzes um einen erheblichen Winkel zu den Streifen geneigt ist, auch noch eine dauernd mit einer Öffnung versehene Schicht (52) vorgesehen ist, die einen ähnlichen Aufbau aufweist, jedoch keinen solchen Schlitz hat.

Revendications

1. Paroi déflectrice de rayonnement thermique (10) pour un dispositif destiné à être utilisée dans la solidification dirigée de matière à cristaux, la paroi déflectrice étant montée à une extrémité d'un four et, en service, il doit se produire un mouvement linéaire relatif entre un moule et la paroi déflectrice lorsque le moule doit être retiré du four, caractéri-

sée en ce qu'est bridée en position à l'intérieur de la paroi déflectrice, au moins une couche (12; 22; 32) de bandes flexibles (14; 24; 34) interconnectées de matériau réfractaire, et en ce que chacune de ces couches est constituée par un agencement ordonné de ces bandes, et comporte au moins une fente (16; 26; 36) dans celle-ci pour permettre au moule de passer au travers de la couche, avec les bords de chaque fente venant en contact avec le moule de manière élastique, et en ce qu'au moins sensiblement la totalité de chaque fente est inclinée sous un angle significatif par rapport aux bandes.

2. Paroi déflectrice selon la revendication 1, caractérisée en ce que la, ou au moins une couche de bandes interconnectées a un agencement ordonné par le fait de comprendre des bandes entrelacées.

3. Paroi déflectrice selon la revendication 1 ou la revendication 2, caractérisée en ce que les bandes interconnectées de la, ou d'au moins une couche sont constituées par des fils.

4. Paroi déflectrice selon la revendication 3, caractérisée en ce que la, ou au moins une couche de bandes interconnectées a un agencement ordonné par le fait de comprendre des fils tricotés.

5. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce qu'au moins sensiblement la totalité de la ou de chaque fente est inclinée sous un angle significatif plus grand que ou égal à 10° par rapport aux bandes.

6. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce que la, ou au moins une fente ménagée dans une couche de bandes interconnectées s'étend globalement de manière linéaire.

7. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce que les bandes de la couche sont entrelacées à angle droit et en ce que chaque partie de chaque fente s'étendant de manière linéaire prévue est inclinée sous l'angle significatif de 45° par rapport à toutes les bandes.

8. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce que la, ou au moins une couche de bandes interconnectées est pourvue d'une ouverture permanente, en plus de la ou de chaque fente.

9. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce qu'une pluralité de couches de bandes interconnectées est prévue et en ce que les fentes des différentes couches ne sont pas alignées les unes avec les autres.

10. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce qu'une pluralité de couches de bandes interconnectées est prévue et en ce que différentes couches ont des agencements ordonnés différents.

11. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce que la, ou au moins une couche bridée en position comporte au moins une fente ménagée entre deux morceaux séparés de bandes interconnectées adjacents dans le plan de la couche, au niveau de chaque bord adjacent des morceaux, l'agencement étant tel qu'au moins sensiblement la totalité de la fente est inclinée sous un angle significatif par rapport aux bandes formant les morceaux associés.

12. Paroi déflectrice selon la revendication 11, caractérisée en ce que les bords adjacents des morceaux sont respectivement en butée l'un contre l'autre.

13. Paroi déflectrice selon la revendication 11, caractérisée en ce que les bords adjacents des morceaux sont dans une relation de chevauchement l'un par rapport à l'autre.

14. Paroi déflectrice selon l'une quelconque des revendications précédentes, caractérisée en ce qu'en plus de comporter au moins une couche de bandes interconnectées, avec un agencement ordonné des bandes, il est prévu une couche n'ayant pas un tel agencement ordonné.

15. Paroi déflectrice selon l'une quelconque des revendications 1 à 13, caractérisée en ce qu'en plus de comporter au moins une couche de bandes interconnectées, avec un agencement ordonné des bandes, et pour chaque couche se présentant ainsi de comporter au moins une fente en elle, avec au moins sensiblement la totalité de chaque fente inclinée sous un angle significatif par rapport aux bandes, il est également prévu une couche (52) pourvue d'une ouverture permanente, ayant une configuration similaire, mais ne comportant pas une telle fente.

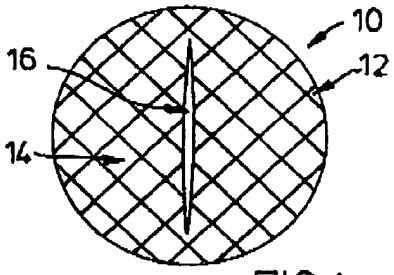

FIG.1

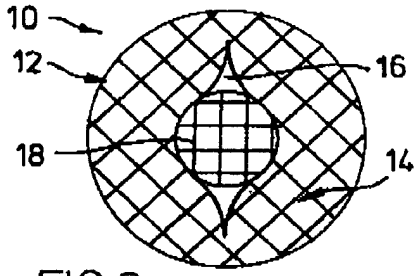

FIG.2

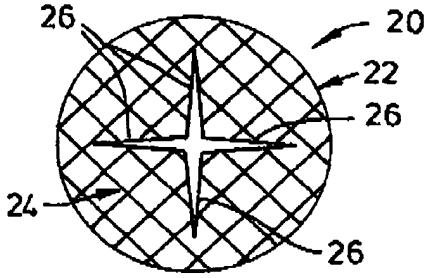

FIG.3

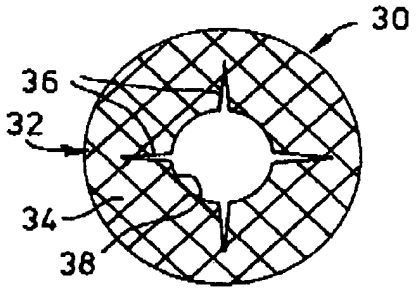

FIG.4

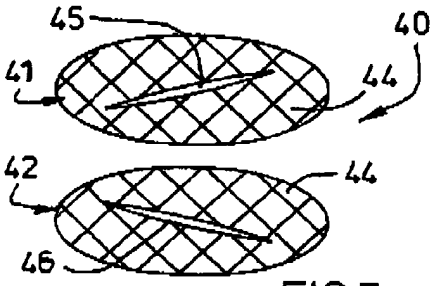

FIG.5

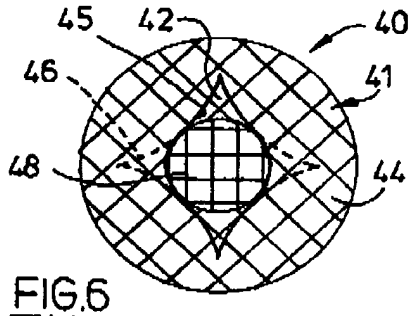

FIG.6

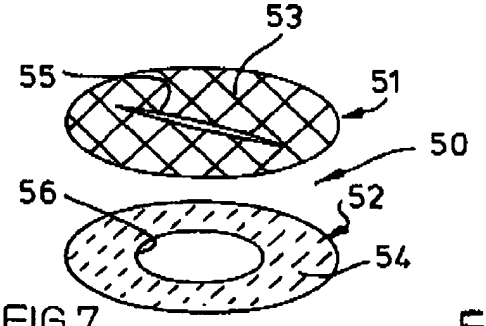

FIG.7

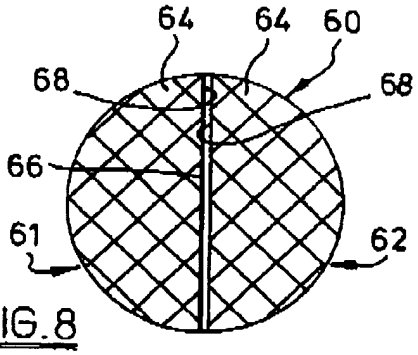

FIG.8